**Name of Organization:** SUNY Research Foundation

**Type of Organization:** College or University

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**Project Title:** Disposition and Metabolism of PBDEs in Fish

**Project Category:** Emerging Issues

**Rank by Organization (if applicable):** 0

**Total Funding Requested ($):** 155,999 **Project Duration:** 2 Years

**Abstract:**

Polybrominated diphenyl ethers (PBDEs) are widespread environmental contaminants because of their extensive use as flame retardants in a large variety of products. Recently, these chemicals have been detected in fish from the Great Lakes. PBDEs are likely to accumulate in the Great Lakes biota because of high lipophilicity of these chemicals. Recently, these chemicals have been detected in fish from Lakes Ontario, Michigan, and Huron. However, information on the disposition and metabolic fate of BPDEs in fish is totally lacking. Basic data on tissue distribution, metabolism, and excretion of these chemicals are needed to have a better understanding of their fate and effects in fish. The objective of the proposed research is to investigate the disposition and metabolic fate of 2, 4, 2', 4'-tetrabromodiphenyl ether and 2, 4, 5, 2', 4'-pentabromodiphenyl ether in rainbow trout, a model fish species. The two chemicals are the predominant PBDE congeners detected in fish from the Great Lakes.

**Geographic Areas Affected by the Project**

**States:**

- [x] Illinois
- [x] Indiana
- [x] Michigan
- [x] Minnesota
- [x] New York
- [x] Pennsylvania
- [x] Wisconsin
- [x] Ohio

**Lakes:**

- [ ] Superior
- [ ] Huron
- [ ] Michigan
- [ ] Erie
- [ ] Ontario
- [x] All Lakes

**Geographic Initiatives:**

- [ ] Greater Chicago
- [ ] NE Ohio
- [ ] NW Indiana
- [ ] SE Michigan
- [ ] Lake St. Clair

**Primary Affected Area of Concern:** Not Applicable

**Other Affected Areas of Concern:**

***For Habitat Projects Only:***

**Primary Affected Biodiversity Investment Area:**

**Other Affected Biodiversity Investment Areas:**

**Problem Statement:**

Polybrominated diphenyl ethers (PBDEs) are used as flame retardants in a wide variety of products, including plastics, resins, buildings materials, rubber, and textiles (1,2 ). Because of their extensive use, these chemicals are ubiquitous environmental contaminants(1-4). They have been detected in human blood, milk and adipose tissue, various wildlife species and fish. Most recently, the presence of PBDEs has been detected in lake trout from Lake Ontario and Lake Huron (5 ) and in steelhead trout from Lake Michigan ( 6 ). The PBDE residues in these fish species consisted predominantly of 2, 4, 2', 4'-tetrabromodipheryl ether (TeBDE, BDE-47), and 2, 4, 5, 2', 4'-pentabromodiphenyl ether (PnBDE, BDE-99) congeners. A selective accumulation and retention of TeBDE and PnBDE by fish may result from congener-specific absorption and/or congener-specific metabolism and excretion.

Due to their high lipophilicity, bioaccumulation of PBDEs by the biota in the Great Lakes is expected. The limited work reported thus far concerning PBDEs in fish has focused on determining the residue levels of these chemicals in these organisms collected from chemically-contaminated areas. No information is available on the disposition and metabolic fate of PBDEs in fish. Basic data on tissue distribution, metabolism, and excretion of these chemicals are needed to have a better understanding of their behavior in fish and thus to predict the magnitude of body burden in fish resulting from exposure to PBDEs.

We propose to investigate the disposition and metabolic fate of 2, 4, 2', 4'-TeBDE and 2, 4, 5, 2', 4'-PnBDE in rainbow trout. The specific aims of the proposed research are as follows: (i) to determine the kinetics of tissue distribution and elimination of TeBDE and PnBDE in rainbow trout, and (ii) to determine the levels of TeBDE and PnBDE and their metabolites in muscle, liver bile of rainbow trout . We selected TeBDE and PnBDE for these studies because they are the predominant PBDE congeners detected in fish. Also, the rate of metabolism and hence the persistence of the two congeners in fish is expected to vary because PeBDE and PnBDE differ with regard to the degree of chlorination.

We intend to examine the disposition and metabolic fate of TeBDE and PnBDE in rainbow trout (approximately 6" long) following oral administration of the 14C-labeled chemicals to the fish at a sublethal dose. The tissue distribution and metabolism of the two PBDEs will be examined in untreated fish and in fish which have been previously exposed to an inducing dose of a PCB mixture e.g. Aroclor1254 in order to assess the disposition and metabolic fate of PBDEs in fish inhabiting non-polluted and polluted areas, respectively. A group of fish will be sacrificed at appropriate intervals following treatment with 14C-TeBDE or 14C-PnBDE and the amount of total radioactivity and of the parent compound in various tissues (e.g. liver, mesenteric adipose, muscle, gall bladder, and GI tract) will be determined. To gain information on the metabolic fate of TeBDE and PnBDE in rainbow trout, the extract of tissues containing a sufficient amount of radioactivity will be analyzed by HPLC according to Haak et al (7). The major PBDE metabolites will be characterized by GC/MS following methylation.

Expected Significance: The proposed studies on the disposition and metabolic fate of toxicologically significant TeBDE and PnBDE will provide information on the degree to which these PBDE congeners accumulate in fish and the extent of metabolism of these chemicals to non-toxic and potentially toxic metabolites. These findings will be useful in assessing the risk that the PBDE congeners present to fish and in designing water-quality criteria. The data will also help in ascertaining the degree of human exposure to PBDEs and their potentially toxic metabolites via consumption of fish contaminated with these chemicals.

References

1. van Esch, G. J. 1994. Environ. Hlth Criteria 162, World Health Organization, Geneva.
2. Pijnenburg, A. et. al. 1995. Rev. Environ. Contam. Toxicol. 141:1.
3. Jansson, B. et. al. 1993 Environ. Toxicol. Chem. 12: 1163.
4.. Lindstrom, G. et. al. 1999 Arch. Contam. Toxicol. 36:355.
5. Alaee, M. et. al. 1999 Organohalogen Compds. 40:347.
6. Asplund, L. et. al. 1999. Organohalogen Compds. 40:351.
7. Haak, H. et. al. 1999. Organohalogen Compds. 40:337

**Proposed Work Outcome:**

| **Project Milestones:** | **Dates:** |
|---|---|
| Project Start | 10/2000 |
| Toxicity of TeBDE | 11/2000 |
| Disposition of TeBDE | 04/2001 |
| Metabolism of PeDBE | 09/2001 |
| Toxicity of PnBDE | 10/2001 |
| Disposition of PnBDE | 03/3003 |
| Metabolism of PnBDE | 08/2002 |
| Project End | 09/2002 |

☐ Project Addresses Environmental Justice

**If So, Description of How:**

☐ Project Addresses Education/Outreach

**If So, Description of How:**

**Project Budget:**

| | Federal Share Requested ($) | Applicant's Share ($) |
|---|---|---|
| **Personnel:** | 63,240 | 17,864 |
| **Fringe:** | 18,339 | 5,180 |
| **Travel:** | 3,800 | 0 |
| **Equipment:** | 0 | 0 |
| **Supplies:** | 28,000 | 0 |
| **Contracts:** | 0 | 0 |
| **Construction:** | 0 | 0 |
| **Other:** | 11,000 | 0 |
| **Total Direct Costs:** | 124,379 | 23,044 |
| **Indirect Costs:** | 31,620 | 30,829 |
| **Total:** | 155,999 | 53,873 |
| **Projected Income:** | 0 | 0 |

**Funding by Other Organizations (Names, Amounts, Description of Commitments):**

**Description of Collaboration/Community Based Support:**